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Does point-of-care testing in general practice for leucocyte and differential count change use of antimicrobial medicines? A pilot study

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Abstract. Diagnostic uncertainty when considering prescription of antimicrobials ('antibiotics') in primary care contributes to the major problem of microbial resistance. We conducted a feasibility evaluation of rapid testing for leucocyte and differential count in two urban general practices, surveying the GPs online and interviewing them. GPs reported that the machines were easy to use, the test results influenced their care and they would adopt the system if costs were off-set. Feasibility, acceptability and perceived benefit justify a randomised trial to test the effect on antibiotic prescribing rates and quality of care, with an economic evaluation to inform the cost-benefit.

Keywords: ambulatory care facilities, delivery of health care, diagnostic services, point-of-care systems, primary health care.

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Introduction

Deciding whether to prescribe antibiotics is often difficult, and GPs tend to err on the side of caution, prescribing more antibiotics than guidelines recommend (McCullough *et al.* 2017). This might contribute to the antibiotic resistance crisis (O'Neill *et al.* 2015; Australian Government 2018). In support of the urgent need to reduce antibiotic use, there is an increasing focus on general practice, where the greatest volumes of antibiotics are prescribed for human use (Choosing Wisely Australia 2018; NPS MedicineWise 2018).

One problem is that of diagnostic uncertainty in general practice (Del Mar *et al.* 2017). Several near-patient testing interventions, including C-reactive protein and procalcitonin, have been shown to reduce antibiotic use (Tonkin-Crine *et al.* 2017), as has total leucocyte and differential count in a paediatric practice (Casey *et al.* 2003; Casey and Pichichero 2009). GPs report that they would like to have more point-of-care (POC) tests available to them, including leucocyte count (Howick *et al.* 2014). Australian GPs' low use of point-of-care tests that might influence decisions about the prescribing of antibiotics may result largely from a lack of support for this through Medicare or other public funding.

Hemocue WBC DIFF machines (www.hemocue.com/en/solutions/hematology/hemocue-wbc-diff-system, accessed 16 September 2020), which provide total leucocyte and differential counts in 5 min from a finger-prick drop of blood, are being used in remote health centres (Spaeth *et al.* 2015, 2019) and small rural hospitals around Australia without on-site pathology services (Radiometer Pacific, pers. comm.). The accuracy of this machine has been confirmed (Simpson *et al.* 2009; Kok *et al.* 2015). We wondered whether this test could be used by urban GPs with a view to similarly support clinical decisions.

As a preliminary to formal testing of these objectives, we decided to evaluate the feasibility, acceptability and perceived utility of this system.

Specifically, we wanted to know whether GPs and practice nurses could adapt the test to their workflow; whether and how the results of the test changed care; and whether the system was seen as valuable enough to use, if costs were not a problem.

The practice innovation

Method

The Australian distributor (Radiometer, Mount Waverley, Vic., Australia) installed four Hemocue WBC DIFF machines in two urban general practices in Adelaide, South Australia, provided all consumables and maintained the machines. Participating GPs and practice nurses were trained in the use of the machines during a 1-h meeting at each practice in March and April 2018, respectively, which was run by Radiometer staff and Dr Oliver Frank. GPs were free to use the machines until September 2018

Table 1. Responses from GPs to the online survey
Data are presented as *n*

	Yes	No	
Did you learn to use the Hemocue WBC DIFF machine?	13	1	
	Very easy	Easy	Difficult
How easy or difficult was it to use the Hemocue WBC DIFF machine?	1	10	2
	Yes	No	
Did you use the Hemocue WBC DIFF machine for any of your patients?	10	3	
	Yes	No	
Did using the Hemocue WBC DIFF machine change your care of any of those patients?	4	1	
	I	A practice nurse	
Who collected most of the specimens and ran the WBC DIFF tests for your patients who were tested?	9	1	
Comments from representative feedback	I prescribed an antibiotic for one or more patients when I might otherwise not have done so	I decided not to prescribe an antibiotic for one or more patients when I had been considering it (either because the patient was asking for a prescription or because I had thought that an antibiotic might be indicated)	It influenced my care in other ways
How did the results of the WBC DIFF test influence your care of different patients? (Please choose as many as apply)	4	5	2
	Yes	No	Unsure
If adequate funding was made available so that your time, your practice nurse's time, and all costs of having a Hemocue machine and running it were paid for, would you continue to use the Hemocue WBC DIFF machine?	6	2	1

to perform total leucocyte and differential counts for any patient that they wished.

We surveyed the GPs in late September 2018 using a Web-based service (www.surveymonkey.com) using eight fixed-response questions and one open-answer question, and interviewed GPs and practice nurses in a group at each practice, audio recording these and transcribing relevant parts of the interviews.

We obtained ethics approval (number H-2018–014) from the University of Adelaide. All participants gave written informed consent.

Results

Participation in the study was agreed by 14 of 29 GPs, two GP registrars and 4 of 10 practice nurses. All 14 GPs completed the online survey and 13 GPs and four practice nurses participated in the group interview. The registrars' terms ended during the study and they did not provide any feedback.

Approximately 95 tests were performed for patients during the study. This equates to an average of one test per GP per month. The responses to questions from the online survey are shown in Table 1, and representative feedback given at the group meeting interviews are shown in Box 1.

Most of the participating GPs found it easy to learn to perform the tests and reported that the results influenced the care they provided. They reported that the finding of a normal white cell count and absence of neutrophilia was reassuring to them and to patients, and that this influenced them not to prescribe an antibiotic for patients for whom they otherwise might have done so. They estimated that in routine care, they would use one or two tests a day. However, to continue using the test would require compensation for costs and time for testing.

Discussion

Our assumption that GPs and their practices could learn to use the Hemocue WBC DIFF machine was found to be mostly correct. We learned that the initial training was not enough to enable some of the GPs and practice nurses to use the Hemocue WBC DIFF machine successfully.

Our assumption that GPs would actually perform the white cell counts for patients was also partly correct. Although it was not mentioned in the survey or in the group interviews, we gathered via informal discussions that in the rush of consulting, the GPs often forgot that they had the Hemocue WBC DIFF machine in their practice and they could have used it. We believe that this is something that affects the uptake of many or most new procedures and systems in general practice (Orchard *et al.* 2019). In the cluster randomised controlled trial that we propose, more intensive initial support and follow up of participants, with continuing discussion at practice meetings, will help to make POC testing of total leucocyte and differential counts a part of routine practice in intervention practices. We learned that the 10 min or more required for the whole testing process, including collecting the specimen, taking it to the machine, running the test, reading the result and entering it into the patient's record, could not be accommodated within current practice workflows.

Box 1. Examples of feedback from group interviews

All feedback examples are from GPs (*except one, which was from a practice nurse*; *this is labelled accordingly*).

Learning to use the machine

I was trained, but forgot how to do it by the time I came to use it. It's fairly simple.

I tried three or four times with different patients and failed every time, with different errors [Practice nurse].

Influence on care: the test result influenced me to prescribe an antimicrobial

A 70-year-old man afebrile unwell three weeks after respiratory illness had a neutrophilia, so I diagnosed possible pneumonia and prescribed for him.

I found it useful for adults e.g. exacerbation of a COPD in a patient who had WBC 20.

Influence on care: the test result influenced me not to prescribe an antimicrobial

A woman with really big glands who had been sick for a week or two. ? EBV ? tonsillitis. WBC was normal, so I didn't prescribe. Patient was reassured. Patient came back well a week later, and was happy.

I also had a young child with recurrent infections that had been treated with antibiotics a couple of weeks before. The child had a new fever. I tested her and mother and I were reassured in decision not to prescribe.

Patients who had been wanting or expecting a prescription for an antimicrobial found their normal results very convincing, and immediately accepted my advice about other measures such as rest, paracetamol and fluids for their illness.

Influence on care: the test result influenced my care in other ways

19 year old man with nausea and vomiting that appeared to be gastro, but had 21.7 WBC, referred him to hospital, where septicaemia was found.

Nine month old baby unwell for one week, high fever two days, WCC 28.2 neutrophils 12.9 lymphocytes 12.5, that I had been planning to send home, but instead referred to hospital, where the ED doctors also were going to send him home until they saw the result that we had obtained, and they admitted him instead.

59 year old man with two weeks of aches and pains and night sweats, ? viral illness was found in the Hemocue test to have a lymphocytosis, confirmed subsequently as chronic lymphocytic leukaemia.

It has helped to decide not to request investigations that I was considering, such as ultrasound.

Estimates of patient perceptions

Patients were pleased and impressed that we could do this test, rather than having to wait for a lab result.

Barriers to greater use

GPs reported that it was difficult to fit performing the test into their workflow. Not having a nurse available and free to perform the test when needed inhibited them from testing patients for whom they felt that the test might have been useful.

Some of the participating GPs missed the training sessions, and most GPs reported that having more detailed instructional materials available next to the machine would have helped them to use it.

These results suggest GPs would find the test useful and acceptable if the costs of the machine, consumables and time to perform the tests were funded. Therefore, we suggest that a randomised trial, with an economic evaluation, should be instigated to quantify benefits (decrease in antibiotic use and resistance, improved patient satisfaction), harms (serious outcomes of infections such as those requiring hospital admission) and costs.

Conflicts of interest

The authors declare no conflicts of interest.

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References

Australian Government (2018) Antimicrobial resistance. Australian Government Department of Health and Australian Government Department of Agriculture, Water and the Environment, Canberra, ACT, Australia. Available at https://www.amr.gov.au/ [Verified 25 October 2018]

Casey JR, Pichichero ME (2009) A comparison of 2 white blood cell count devices to aid judicious antibiotic prescribing. *Clinical Pediatrics* **48**, 291–294. doi:10.1177/0009922808327106

Casey JR, Marsocci SM, Murphy ML, Francis AB, Pichichero ME (2003) White blood cell count can aid judicious antibiotic prescribing in acute upper respiratory infections in children. *Clinical Pediatrics* **42**, 113–119. doi:10.1177/000992280304200203

Choosing Wisely Australia (2018) Antibiotic resources for clinicians. (NPS MedicineWise: Sydney, NSW, Australia) Available at http://www.choosingwisely.org.au/resources/clinicians/ 11111antibiotic-resources-for-clinicians [Verified 25 October 2018]

Del Mar CB, Scott AM, Glasziou PP, Hoffmann T, van Driel ML, Beller E, Phillips SM, Dartnell J (2017) Reducing antibiotic prescribing in Australian general practice: time for a national strategy. *The Medical Journal of Australia* **207**, 401–406. doi:10.5694/mja17.00574

Howick J, Cals JW, Jones C, Price CP, Pluddemann A, Heneghan C, Berger MY, Buntinx F, Hickner J, Pace W, Badrick T, Van den Bruel A, Laurence C, van Weert HC, van Severen E, Parrella A, Thompson M (2014) Current and future use of point-of-care tests in primary care: an international survey in Australia, Belgium, The Netherlands, the UK and the USA. *BMJ Open* **4**, e005611. doi:10.1136/bmjopen-2014-005611

Kok J, Ng J, Li SC, Giannoutsos J, Nayyar V, Iredell JR, Dwyer DE, Chen SC (2015) Evaluation of point-of-care testing in critically unwell patients: comparison with clinical laboratory analysers and applicability to patients with Ebolavirus infection. *Pathology* **47**, 405–409. doi:10.1097/PAT.0000000000000296

McCullough AR, Pollack AJ, Plejdrup Hansen M, Glasziou PP, Looke DF, Britt HC, Del Mar CB (2017) Antibiotics for acute respiratory infections

in general practice: comparison of prescribing rates with guideline recommendations. *The Medical Journal of Australia* **207**, 65–69. doi:10.5694/mja16.01042

NPS MedicineWise (2018) Reducing antibiotic resistance. (NPS MedicineWise: Sydney, NSW, Australia) Available at https://www.nps.org.au/medical-info/clinical-topics/reducing-antibiotic-resistance [Verified 25 October 2018]

O'Neill J, Davies S, Rex J, White LJ, Murray R (2015) Review on antimicrobial resistance. Antimicrobial resistance: tackling a crisis for the health and wealth of nations. (HM Government Wellcome Trust: London, UK) Available at http://amr-review.org/sites/default/files/AMR%20Review%20Paper%20-%20Tackling%20a%120crisis%20for%20the%20health%20and%20wealth%20of%20nations_1.pdf [Verified 9 May 2020]

Orchard J, Li J, Gallagher R, Freedman B, Lowres N, Neubeck L (2019) Uptake of a primary care atrial fibrillation screening program (AF-SMART): a realist evaluation of implementation in metropolitan and rural general practice. *BMC Family Practice* **20**, 170. doi:10.1186/s12875-019-1058-9

Simpson PA, Tirimacco R, Chooi C, Tideman PA (2009) Evaluation of the Hemocue White Blood Cell Point of Care Instrument. Proceedings of the Australasian Association of Clinical Biochemists' 47th Annual Scientific Conference. *Clinical Biochemist Reviews* **30**, S41.

Spaeth BA, Shephard MD, McCormack B, Sinclair G (2015) Evaluation of HemoCue white blood cell differential counter at a remote health centre in Australia's Northern Territory. *Pathology* **47**, 91–95. doi:10.1097/PAT.0000000000000202

Spaeth B, Shephard M, Kokcinar R, Duckworth L, Omond R (2019) Impact of point-of-care testing for white blood cell count on triage of patients with infection in the remote Northern Territory of Australia. *Pathology* **51**, 512–517. doi:10.1016/j.pathol.2019.04.003

Tonkin-Crine SK, Tan PS, van Hecke O, Wang K, Roberts NW, McCullough A, Hansen MP, Butler CC, Del Mar CB (2017) Clinician-targeted interventions to influence antibiotic prescribing behaviour for acute respiratory infections in primary care: an overview of systematic reviews. *Cochrane Database of Systematic Reviews* **9**, CD012252. doi:10.1002/14651858.CD012252.pub2